WHAT IS CLAIMED IS:

1. A method of balancing a rotating machinery, said rotating machinery having an inner frame, an outer casing, and counterweights connected with a shaft of said rotating machinery, said method comprising:

mounting a proximity probe on said outer casing, said proximity probe configured to provide phase readings to a phase reading output channel, wherein said phase reading is measured in degrees measured with respect to a key phasor;

mounting a first plurality of velocity transducers on said inner frame, each of said velocity transducers configured to provide a first plurality of velocity signals to a first plurality of velocity signal output channels;

mounting a second plurality of velocity transducers on said outer casing, each of said velocity transducers configured to provide a second plurality of velocity signals to a second plurality of velocity signal output channels;

connecting said phase reading output channel, said first and second plurality of velocity signal output channels to a data acquisition system;

collecting vibration data provided by said phase reading output channel, and said first and second plurality of velocity signal channels, using said data acquisition system;

removing said outer casing to allow access to said counterweights; and

adjusting said counterweights using a predetermined rotor influence coefficient to reduce said vibration below an acceptable threshold level.

2. The method of claim 1 wherein said rotating machinery is a three-shaft scroll pump.

3. The method of claim 1 wherein said mounting said proximity probe includes connecting said proximity probe to said outer casing.

4. The method of claim 1 wherein said first plurality of velocity transducers comprises at least two velocity transducers which are installed 90 degrees from each other, in order to provide velocity data in two planes, and wherein one of said at least two velocity transducers is oriented in the direction of the key phasor.

5. The method of claim 1 wherein said second plurality of velocity transducers comprises at least two velocity transducers which are installed 90 degrees from

each other, in order to provide velocity data in two planes, and wherein one of said at least two velocity transducers is oriented in the direction of the key phasor.

6. The method of claim 1 wherein said collecting said vibration data comprises collecting amplitude, velocity, and phase angle data, wherein said phase angle is measured in degrees from said key phasor.

7. The method of claim 1 wherein said collecting said vibration data comprises collecting amplitude, velocity, and phase angle data, for start up, steady state and coast down operating conditions, and wherein said rotating machinery is operating near a resonant condition during said steady state operating condition.

8. The method of claim 1 wherein said shaft is one of three shafts and wherein said counterweights comprise upper and a lower counterweights, wherein each of said shafts is connected with an upper counterweight and a lower counterweight, and wherein said upper and lower counterweights are mounted near the ends of each of said shafts.

9. The method of claim 1 wherein said adjusting said counterweights includes adding correction weights to and removing correction weights from said counterweights.

10. The method of claim 1 wherein said adjusting said counterweights includes adding correction weights to and removing correction weights from said counterweights, and wherein said adjusting primarily comprises said removing when an indicated vibration is in alignment with said counterweights, and wherein said adjusting primarily comprises said adding when an indicated vibration is not alignment with said counterweights.

11. The method of claim 1 wherein said predetermined rotor influence coefficient is obtained from an equivalent rotating machinery, and wherein an equivalent rotating machinery is a rotating machinery operating substantially at resonance.

12. The method of claim 1 wherein said rotor influence coefficient provides a measure for said adjusting said counterweights, and wherein said measure is a weight adjustment per a vibration displacement and a weight placement angle value measured with respect to the location of the maximum vibration displacement.

13. A system for balancing a rotating machinery, said rotating machinery having an inner frame, an outer casing, and counterweights connected with a shaft of said rotating machinery, said system comprising:

a proximity probe configured to be mounted on said outer casing of said rotating machinery, said proximity probe configured to provide phase readings to a phase reading output channel, wherein said phase reading is measured in degrees measured with respect to a key phasor;

a first plurality of velocity transducers configured to be mounted on said inner frame of said rotating machinery, each of said velocity transducers configured to provide a first plurality of velocity signals to a first plurality of velocity signal output channels;

a second plurality of velocity transducers configured to be mounted on said outer casing of said rotating machinery, each of said velocity transducers configured to provide a second plurality of velocity signals to a second plurality of velocity signal output channels;

a data acquisition system for receiving said phase reading output channel, said first and second plurality of velocity signal output channels; and

counterweights configured to be applied to said shaft of said rotating machinery using a predetermined rotor influence coefficient.

14. The system of claim 13 wherein said rotating machinery is a three-shaft scroll pump.

15. The system of claim 13 wherein said first plurality of velocity transducers comprises at least two velocity transducers which are installed 90 degrees from each other, in order to provide velocity data in two planes, and wherein one of said at least two velocity transducers is oriented in the direction of the key phasor.

16. The system of claim 13 wherein said second plurality of velocity transducers comprises at least two velocity transducers which are installed 90 degrees from each other, in order to provide velocity data in two planes, and wherein one of said at least two velocity transducers is oriented in the direction of the key phasor.

17. The system of claim 13 wherein said data acquisition system os configured to collect vibration data comprising amplitude, velocity, and phase angle data, for

start up, steady state and coast down operating conditions, and wherein said rotating machinery is operating near a resonant condition during said steady state operating condition.

18. The system of claim 13 wherein said shaft is one of three shafts and wherein said counterweights comprise upper and a lower counterweights, wherein each of said shafts is connected with an upper counterweight and a lower counterweight, and wherein said upper and lower counterweights are mounted near the ends of each of said shafts.

19. The system of claim 13 wherein said counterweights include correction weights to for adding and for removing correction weights from said counterweights, and wherein said counterweights are removed when an indicated vibration is in alignment with said counterweights, and wherein counterweights are added when an indicated vibration is not alignment with said counterweights.

20. The system of claim 13 wherein said predetermined rotor influence coefficient is obtained from an equivalent rotating machinery, and wherein an equivalent rotating machinery is a rotating machinery operating substantially at resonance.

21. The system of claim 13 wherein said rotor influence coefficient provides a measure for adjusting said counterweights, and wherein said measure is a weight adjustment per a vibration displacement and a weight placement angle value measured with respect to the location of the maximum vibration displacement.